Global synergy plants for depuration, biomass production and thermoelectric cogeneration

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Today's environmental problems are multidisciplinary and (GSPDPTC) is the only system that has been designed with these principles: to treat all problems simultaneously, while still allowing energy production at levels required for modern society. Now thermal fossil plants are a major source of pollution of the atmosphere due to the toxic substances emitted and also a source of significant economic waste due to the enormous amounts of waste heat which is not recovered. the industrial and urban sewage treatment is inadequate, while the urban air purification and water lacustrine and marine does not exist. The structural invention called "purification cogeneration thermal power generation global" (GSPDPTC) retrieves these resources, increases yields, makes clean energy, water purification and desalination, or alkalizes all the waters that run through the system to deacidify lakes and oceans, if only to cool turbines and capacitors. The system is based on the enlargement of energetic plants with new sections to take advantage of the heat and the CO2 they produce. This integrated system includes the new chimney system CCPC that bring down the fumes contributing to the filtration and cooling buildings LDDC that use the heat content in the water to heat large anaerobic digesters producing biogas and compost for agriculture of high quality; vertical synergic buildings "VSB" that consume CO2 and waste heat energy and produce biomass sludge, which will be transferred to the same "LDDC". In "VSB", CO_2 will also be used for the cold carbonation of limestone stored on multiple floors suspended in special trolley baskets. The continuous recycling of water between the limestone section (cmlg) and purifying section (bcsvp) allows for greater absorption of CO_2. The purified water falls down on to the limestone in rains to facilitate the reaction which transforms CO_2 into aqueous carbonates which will be transported to lakes or oceans for deacidification. Alternatively, the entire system can be used to desalinate ocean water. Baskets filled with ion exchange resins are dragged through the water basins underlying the carbonates produced by the corrosion of the rocks to perform another level of water purification. This system moved into urban centers and coupled to the system (GUED), "Global urban environmental depuration", allows the purification of the air and water while producing energy. If coupled to the system (GMLED) "global marine and lacustrine environmental depuration" allows the purification of water and the extraction of the mud which is used to produce energy.

DESCRIPTION

The technical field of this inventionis environmental protection, the conservation of energy resources, the production of new clean energy. **This invention** belongs to a group of inventions that aim at preventing the phenomena of water and atmospheric acidification and the recovering of energetic resources, processes that cannot be carried out with current purification and energy production systems. It is the most important invention of this group because it brings together all the others in a single system so that nothing is been wasted. It is named (GSPDPTC): "Global synergy plant for depuration, biomass production and thermoelectric cogeneration. But to use the entire system, there is need for many other existing technologies, in addition to those claimed. Only by integrating many other technologies and as well as many environmental applications it is then possible to close the anthropic cycles of carbon, nitrogen, phosphorous, to be recovered and reuse the waste heat and CO_2 in the environment.

The background art in the environmental protection concurrent with fossil fuel energy production cannot be based only on the technological level achieved by the related systems, but also on the results achieved in the fight against pollution and yields of energy production. Despite the sophistication of current technology, concurrent treatment of the pollution resulting from the burning of hydrocarbons is still in its infancy. Energy yields are low, because the solutions used in the purification processes do not exploit the synergies between the energy in the cooling water, air and land already available in these plant sites. Energy production has been considered a separate industry sector, especially depuration. Due to this, energy producers have no incentive to produce clean energy and do the minimum work required to meet already weak environmental regulations. In the current short-sighted paradigm, adding technology to clean the environment is tantamount to increased business costs. What they fail to realize is that if they had met the challenge instead of avoid it, it would have resulted in new technology that could easily double efficiency gains through recovery of energy in the lost heat and turn CO_2 into a useful product that in fact protects the environment. The ubiquitous smokestack of fossil fuel plants directly injects pollutants into the atmosphere. They typify the short-sighted open loop design that has led to the current global warming crisis and ocean acidification crisis whereas an intelligent closed-loop industrial design would capture those emissions and use them as valuable feedstock of other industrial processes.

Much scientific research focuses on treatment solutions such as the capture of CO_2 from the environment by chemical or electrolytic alkalization of large areas of marine waters without treatment processes (which could lead to a profound alteration of ecosystems), or by means of artificial trees. But these solutions do not address the source of pollution and therefore cannot treat other environmental problems that accompany the increase of CO_2 in the environment such as acid rain, pollution from SO_x, NO_x, H_2S, NH_4, aerosols, smog or soot. Carbon Capture and Storage (CCS) is the most well known solution for treating the pollution at the source. It is essentially a chemical washing, which reduces the calorific value while capturing the CO_2. Apart from the large reduction in thermal efficiency (which for natural gas and diesel is approx. 11% and up to 30% for coal), the capture does not neutralize the CO_2. It is necessary to compress, liquefy and bury it about a thousand feet deep in pockets carefully selected to avoid future leaks due to seismic disturbances. CCS must avoid dangerous gas CO_2 gas leaks (known as "Nyos effect" named after the Cameroon village of the same name that suffered a catastrophic natural disaster of a large CO_2 release which occurred in 1986). While we continue to exhaust the traditional supplies of oil and gas, oil & gas producers compensate through continual development of new production technologies to mine previously inaccessible fossil fuel reserves such as fracking for shale gas and drilling for methane hydrates. These new techniques are associated with higher economic and ecological costs – leading to pollution of the water table, the ocean, and to earthquakes and tsunami. It is necessary to delete SO_x, NO_x, CO_2 and aerosols from these fuels by using applicant's solutions which he has proposed for at least half a century. In this way, the cost difference between conventional and bioenergy production continues to shrink because at the same time, bioenergy production is making great strides both with crops from the fields (with or without GMO's) and with the production of algal biomasses. However, this type of production can't become sustainable if the industrialization of production continues to steal valuable land required for agricultural food production. To avoid this resource competition, it is therefore necessary to find ways to scale production without competing with agricultural land. This means the use of agriculturally unproductive land or increasing production acreage by building vertically with industrial criteria. At the same time, we must also increase the production capacity of digesters which produce biogas and eliminating at source the CO2 that contains.

In this context being defined, fit authoritatively the “global synergy for depuration plant, biomass production and thermoelectric cogeneration” (GSPDPTC). In these large systems that bring together synergistic thermoelectric power plant (TEP), Chimneys (CCPC), vertical synergic building (VSB), linear digesters dehydrators composters (LDDC), gasometer and many other technologies, in addition to producing energy, they can improve the quality and quantity of water purification, purify the air and fumes that were never really cleaned to begin with and approach the performance of small boilers (flue gas condensation that exceed the performance of lower calorific value of the fuel, since almost all the heat content is recovered in the flue gas). Existing thermal power plants are typically less than 40% efficient, waste incinerators are approximately 15 %, and only combined cycle power plants, which use light fuel and twin turbines (gas + steam) can reach yields that exceed 50%. The rest of the energy is lost in two ways: 1) transformed into heat that is poured into the water crossing the plant and used to cool the elements that are hot during the process of energy production, in particular turbines and condensers and 2) dispersed in the fumes. With (GSPDPTC) we can recover this heat to produce more electricity that, in fact, increases the efficiency of the thermoelectric plant. This technology can also recover the heat from a blast furnace, an incinerator or a cement plant, which normally only produces pollution. As will be shown in this ” PCT request”, the easiest and cheapest way to take advantage of the thermal energy is to use it to produce biogas through (LDDC), the subject of another Parallel “PCT request”, while the recovery of heat from the CO_2 fumes and industrial and municipal waste, is treated in detail in PCT request (CCPC), “capture purification cooling chimney “, and VSB, “vertical synergic building”, which are the subject of other parallel “PCT request”. (GSPDPTC) can use the produced biogas locally; send to a new thermal power plant, or to an urban gas network. The biogas produced in these plants will be very similar to natural gas as CO_2 depleted thanks to the synergy between (LDDC) and (VSB). But (GSPDPTC) can also receive from the urban network smoke, smog and polluted waters. The urban cleansing is shortened by the acronym (GUED), global urban environmental depuration and one called “Global marine and lacustrine environmental depuration” (GMLED). GSPDPTC is a multidisciplinary project that puts together different plants, technologies and processes as well as the claims are some how functional as they embrace other sectors. Some of these claims regards the central system where all the energetic resources are recovered, others regards other necessary modifications to the peripherical sections that already have been invented such as the (GUED + GMLED) in order to be able to link it to the central unit (GSPDPTC). These changes however regard above all the anaerobic line of linkages of the mud’s to the central unit. Infact, not being part of the actual state of the art the possibility of locally benefiting from the potential power of the muds, (GUED + GMLED), the applicant has used the chemical dehydration and stabilization of the muds. Obviously, the innovations brought to the GSPDPTC, ridimensions also these systems that should also be innovative in respect to the actual one. Nevertheless, for the actual system it is not useful to waste the technology in the sewage system. The entire evolution of the sewage system exsist only for applicant that has put it on paper, but his inventions has never been realized. But even in the sewage system, it is possible to recover energetic resources. With the (GSPDPTC), there is no need of having any more pumps in the urban (pvum) to lift up the mud and settlers put close to the (pvmm – pvlm) of marine or lacustrine application when the muds are extracted from below through the (asc or assc) “anaerobic sludge submergible collector”. The (GSPDPTC) system will carry to the Energy production that is not simply clean, that could be considered as wind and solar energy, if only the problems are been excluded from the recycling of the materials after been used. The Energy produced from the (GSPDPTC) system nevertheless, protect the environment as it consents to substitute to the sea alkaline water without producing oxide of calcium at the expenses of the CO_2 and to produce energy and mineral salt for agriculture at the expenses of heat been wasted today. The GSPDPTC is not like the current treatment system that does not extract anything, because the energy is destroyed in the sewer gas paths from the acids formed: SOx, H2S, H2SO4 , SOx , NOx, NH4 and purifiers cannot do anything except spend more energy to oxygenate the waters. The new system will not emit CO2 gases into the atmosphere even absorb energy but do not produce, it will be odorless so can be realized in the same city sewer while shortening the paths that will be different from the current ones. Even a small country can have a mini (GUED) & mini (GSPDPTC) that together will purify the environment and produce energy. Proposed technologies such as artificial trees cannot recover the heat nor purify the environment of all the anthropogenic atmospheric emissions. They cannot even purify water, because ultimately, to have significant depurative impact, these processes must take place directly at the pollution source, not after they have already been emitted into the environment.

The current systems are not able to do so and if future plants are designed according to the same open-loop design principles, they too will fail to address the fundamental problem. The proper framework to create an effective global depuration system is a public one. Private industry does not have the capacity and authority to implement such sweeping changes, only governments do. Hence, governments must take the lead in creating the environmental depuration framework as a global public works project and form public-private partnerships for investment, implementation and industry participation. In order to eliminate waste from industrial processes, energy production must be integrated tightly with depuration from the outset, not as an afterthought. The best technologies available must then be selected to integrate into (GUED) and (GSPDPTC) to form the complete system. Following this strategy will result in significant energy efficiency and depuration gains. These gains are only possible by breaking down the existing silos between different industries to create the most effective integrated, closed loop, zero-waste energy production system that can provide society with the energy it requires while reducing emissions to zero. Today, after two centuries of rapid growth under a paradigm of depuration decoupled industrialization, human civilization finds itself inhabiting a planet of dwindling resources and growing pollution. As we face the stark realities of life on a finite planet, it is clear that an industrial paradigm which relies on the continually mining of new resources and generation of copious amounts of pollution will act against our best interests. A fundamental paradigm shift in the entire industrial production system is necessary if we are to ensure our survival. (GSPDPTC) is unique and unlike any previous technology before it exactly because it the industrial design required to ensure the survival of human civilization – one that recycles resources for production and eliminates waste. (GSPDPTC) integrates hitherto separated functions into the same plant site in order to take advantage of the mutual and synergistic feedback effects of each process acting upon the other to recycle materials for production, eliminate waste and increase energy and material yields. The multi-dimensional nature of (GSPDPTC) enables it to handle functions that are currently performed by many different individual plant sites with much lower efficiencies and higher waste output. More specifically, if we are to realize these enormous efficiency gains, production (energy and various materials) and purification plants can no longer function in isolation. Rather, all systems must be integrated and considered as subsystems belonging to a single, large, integrated plant environment. Designers need to be aware that each subsystem can only perform a specific role in the entire process. Together, the industrial symbiosis and closed-loop design will ensure that energy and material is not lost as harmful or wasteful emissions. These plants will become key components for closing the anthropogenic cycles; purification of air and water can both begin and end in the (GSPDPTC). Such a global energy production/depuration system is composed of at least five interconnected plants (excluding the interconnecting and water infrastructure). In the case of treatment of urban sewage, this must be preceded by yet other systems. The overall protective, indoor environment must be organized as a large industrial plant with incoming feedstock and outgoing finished products. The incoming components are: contaminated water, polluted air, heat, CO_2 , SO_x , NO_x , smoke , smog , aerosols, and various additives useful in the processes. The output products are: energy purified alkalized or desalinated water, purified air, liquid digestive and solid compost for agriculture. Of these products, some are produced through simple process pathways while others, such as heat and CO_2 require more complex pathways. These factories of energy production / environmental protection must be scalable to serve both small communities as well as major urban centers. The difference between small and large systems lay in the level of required automation, which arises due to cost issues. The economics of these system dictates that there it is not a one-size-fits-all solution. There is a particular small community size that makes sense to be served by its own autonomous system, as opposed to being serviced by a larger overall system. In many countries such as Italy, such small communities have created consortiums of municipalities that together invest in larger infrastructure to purify water and degenerate slurry. Doing so deprives each community of the potential power and energy produced in these new systems while consuming vast resources on unnecessary transport, subsequent regeneration and other unnecessary processes. (GUED) and

(GSPDPTC) offer complete smaller scale solution that can purify polluted water and air. In the older paradigm, designers designed centralized treatment structures and transported polluted water there only because technology such as (GSPDPTC) with its various versions of “covered purifiers” was not available.

Due to the integration of hitherto disconnected industrial systems, (GSPDPTC) achieves vast energy and depuration efficiencies that, in one sense do not cost an extra Dollar / Euro to achieve.these efficiencies are simply the benefits that arise from placing different plants adjacent to each other in close proximity so “waste” outputs of one plant, normally sent to the atmosphere or hydrosphere as a pollutant are instead reabsorbed as feedstock by the adjacent plant to produce significant amounts of additional energy or depuration. Much smaller power plants using the (GUED) and (GSPDPTC) system are no different than their larger counterpart; they allow the heat and pollution to be recycled back into feedstock and consumed so that it is helpful to the environment and the economy. In this application, for the purpose of illustration, the applicant describes a particularly large plant to highlight its potential, keeping in mind that these modular systems apply equally to small industrial units and urban areas with a less automated material handling. The absence of the synergies in current industrial plant design makes it practically impossible to close the anthropogenic industrial cycles in the same way that nature closes her cycles – found in such natural processes as oxidation, aerobic and anaerobic digestion and especially the fossilization of organic and inorganic materials – each of which belong to a closed-loop natural cycle which conserves energy or materials. Experts have tried several times to recover waste heat to warm cities which are far away from the power source. The widespread distribution of heat and insulation needed are more expensive than heat production made directly on site with modern flue gas with condensing boilers.

So far, district heating is the best that engineers can do to recover the energy in waste heat generated at thermal plants. To create efficient designs to recover energy from the heat of thermal power plants and heating plants in general requires co-locating digesters on the fossil fuel plant site. Such digesters can theoretically produce new energy on the spot by recovering the waste heat and using it to biologically produce methane. However, current digesters are not suitable because they have very low digestive capacity. The best of the current digesters rarely exceeds megawatts of power, which is miniscule when compared to the Gigawatt output of most thermal power plants in use today. There are many power plants in the 2 Gigawatt and above and China and a few other countries have thermal power plants going up to 6 Gigawatts. Therefore, to be useful, it is necessary for the digesters to become much more powerful. The linear digester dehydrator composter (LDDC) solves this problem. The new design allows for the biological production on a scale that matches existing large power plants. It does this by allowing long continuous runs of linear heating pipes to heat the digestive slurry as well as having many loading and unloading hoppers and stations along the system which ensures autonomous exit and entry of biomass. This allows a degree of isolation and prevents the production cycle of each type of biomass from interfering with each other, which can lead to significant degradation of energy output. Existing digester systems are beset with a number of other problems including: 1) notorious for the foul odors they emit; 2) Foul odors produced from composting facilities where the solid digestate is transferred; 3) management of liquid digestate which also includes foul odors which must be purified and deodorized; 4) quality of the biogas produced limited by CO_2-rich environment which reduces calorific value of the produced methane. The design of (LDDC) resolves all these problems, incorporated into the steps of dehydration and composting; aerobic processes which follow immediately to anaerobic digestion.

The (GSPDPTC) system operates efficiently. It may delegate specific functions to each subsystem to handle: 1) the new industrial and urban chimney system (CCPC); 2) the digester building (LDDC); 3) the adjacent vertical synergic building (VSB) (which is always coupled with (LDDC) to receive the air, CO_2 and liquid digestate expelled from (LDDC). “VSB” and “LDCC” systems do not exist in the current state of the art. These levels of bioenergy cannot be achieved by simply turning farmers and their fields into producers of energy, as often happens today. Farmers will never be able to perform the many other important functions that a complete (GSPDPTC) system can – recover all the waste heat of thermal power plants, mitigate all CO_2 and aerosol emissions, purify, alkalize or desalinate feedstock water, produce compost that is directly bagged and ready for shipment, reduce odors that current processes entail, produce crops using industrial processes with production capacity tens of times higher for the same space, and vertical production capacity which increase yields on the same space hundreds of times higher. Renewable energy technology, whether in the form of thermoelectric power, solar, wind or bioenergy are all improving incrementally while the global decarbonisation that is required to stay below a 2°C global temperature is a massive step change. Campaigns for personal lifestyle change are also proving to have no significant impact. During this critical transition stage of humanity, the (GSPDPTC) system is theoretically one of the realistic ways to achieve this scale of required change. Today, the energy and depuration landscape is undergoing monumental change. Renewable energy prices are beginning to plummet to levels competitive with coal, yet as of 2012, the World Resource Institute still reports 1200 new coal fired plant projects slated to be built, 70% of them in China and India. The World Bank’s announcement in 2013 to no longer fund dirty coal projects will help reduce carbonization and also spur development of clean coal solutions. The Oil & Gas industry, however, shows no signs of slowing down production. The advent of cheap and plentiful gas stocks due to fracking technology has lowered Levelized Cost of Energy (LCOE) prices of natural gas far below that of coal. Tar sands and Deep sea production and exploration continue unabated. It is clear that the fossil fuel industry is generally in strong denial about CO_2 emissions as the cause of global warming because of their vested interests. Major global energy institutions, most prominently the IEA project that fossil fuel will still constitute the major share of our energy supply by 2050. If this is true, then fossil fuel mitigation technology will become critical to avoid a world that exceeds 2°C. The IEA promotes Carbon Capture and Storage (CCS) as the large scale solution for rapid CO_2 mitigation produced by fossil fuel power plants. However, even the IEA is worried at the slow rate of progress in CCS. There is a glimmer of hope offered by China agreeing to rapid development in CCS but these are still in pilot plant stages, as are all CCS projects in the world today. Global CCS R+D costs have already exceeded many tens of billions of dollars, without producing a scalable solution and also uncovering the many challenges facing this technology, the biggest being the high cost of implementation and the public perception and justified fear that buried CO_2 can be liberated as a result of seismic activity. Coal plants as well as coal plants with CCS technology are increasingly becoming challenging as an investment option. A June 2012 paper from the U.S. Congressional Budget Office (CBO), “Federal Efforts to Reduce the Cost of Capturing and Storing Carbon Dioxide,” analyzed five engineering studies on building a new coal-fired power plant equipped with CCS and concluded that the LCOE of new coal plant with CCS, in 2013 dollars is between \$0.09 to \$0.15 per kilowatt-hour (kWh). Bloomberg says the average price of power from a new coal plant is \$ 0.128 per kilowatt-hour. Studies from the US Department of Energy estimates that post combustion CCS reduces plant efficiency by 20 to 30 % while a 2007 study from MIT found that a CCS retrofit to existing subcritical pulverized coal plant would reduce efficiency by 40%. In contrast, the LCOE of renewable energy projects, especially solar are now coming in at \$ 0.07 to \$

0.095 per kilowatt-hour. Natural gas is presently the lowest cost of all technologies. According to the EIA Annual Energy Outlook 2012, power from a gas power plant without CCS costs $0.0686 per kilowatt-hour. Subsequently, most new power plants in the US are either natural gas or renewable. Meanwhile, coal prices continue escalating and solar prices continue dropping. It is within this shifting and very fluid energy landscape that (GSPDPTC) is positioning itself. (GSPDPTC) is in a unique position in that it offers fossil fuel plants the ability to 1) both mitigate CO2 and offer enhanced energy production and 2) produce energy entirely from biomass. This future proofs and protects the investment of fossil fuel plant owners. Unlike all competing renewable energy solutions, (GSPDPTC) is multi-dimensional and performs many other very important functions aside from producing clean energy.

The disclosure of this invention. The GSPDPTC system putting together energy production with purification systems, changes especially those purification. You do not need to even save the very recent inventions of the applicant that have not yet been realized. In particular, the GUED “Global urban environ mental depuration” system and the GMLED “Global marine and lacustrine environmental depuration” in which the applicant, uses the “purifying vertical modules(pvm)” which are the (u) “urban” (l) “lacustrine” (m) “marine” versions. The lines anaerobic sludge collector (asc) end anaerobic sludge submergible collector (assc) are part of the GSPDPTC invention, because without the connection to this system the urban, lacustrine and marine muds cannot produce energy in a very simple way. Infact this is the right way to depurate the urban water as the muds are to be seperated immediately from the water, they cannot be carried down into the sewage for hundreds of kilometers. It is enough to think that the firm that manages these plants of the city of Rome (ACEA has estimated a total length of the sewage as 3.500 km. How on earth could one think of depurating the waters after such a mixing with the sustainable cost and it is not possible to wounder out on the accumulative illnesses of coming from the muds (floating, bulking, rising) when in the very long sewages passages they have already generated substances such as ammoniacal nitrogen (NH_4), sulfide hydrogen (H_2S) and even sulfuric acid (H_2SO_4). This brings an enormous wastage of the addictive chemical in the depurative plants that can deal with these reasons only a small amount of water. Even moderate rains will put the system to a state of crises obliging the system to empty out the liquids without any form of treatment. The GSPDPTC system putting together the energetic system with that of the depuration and involving a flow of water very much superior that in the end obliges changes also tot the depurative system that is insufficient for the environmental needs. The new system anticipates the depurative process in the cities through these (pvum), the muds immediately seperated from the waters, the plants are however connected among themselves by means of direct and submerged till they get to these LDDC of the GSPDPTC much close. There will only raining and depurate water in the sewage that will any how superficially travel. There is no need of putting together small cities to depurate the waters, this means that even a small town may be automous in view of the energetic power and depurative, and not only for the waters but also for the air. The latter can then be put side by side and be immersed in lakes or sea flowing water, or be buried on the coasts that are connected to the docks. The purifying water must be coming from those present in the basins in order to develop oxygenation. These inventions, although considered to be very advanced compared to the current state of the art, anyhow, up to the inventions of the “VSB” and “GSPDPTC” these were still somehow regarded as incomplete, because they had not yet solved the following problems: 1) the high consumption of oxide of calcium that would have been consumed to alkalize the water, 2) the failure to exploit ionic water exchange with the calcareous material that can occur in the same stage of oxidation by simply lifting the water and making them slide on the said material, in a CO_2 covered environment enriched by the process of oxidation 3) the impossibility of sludge extraction, which had to be almost completely consumed by oxidation endogenous, with low power consumption, and 4) the lack of exploitation of biological energy producible by nutrients contained in the water. Obviously, the potential consumption of the CO_2 are significantly lower than those of the VSB, which store large amounts of calcareous material, but sufficient to prevent purifiers contribute to increasing CO_2 emissions, as the current purifiers do. These purifiers have inspired new inventions and have been passed from them, but have also been improved by these inventions. In fact, (mgg) “mini greenhouse glazing”, inspired by the “VSB” invention first solve the two issues of the above four mentioned factors, and (asc) “anaerobic sludge collector” inspired by the “GSPDPTC” general system that solves the other two problems. These purifiers have an independent life of the “GSPDPTC” general system but working in parallel to it. In the Gued fig 5 scheme and in the details of Fig. 6 to 9, we can also see how you can improve the existing sewerage system and how it can become a purifying water and air. In the present sewers, only rainwater circulates and this is purified by (pvum) that will go towards the water bodies or be captured again by the “GSPDPTC” system to be reused, while the CO_2 consumed by (pvum) is compressed and sent to the central VSB. The sludge cannot be degenerated by continuous mixing with fresh organic matter and hydrogen sulfide, as the conduct (asc) is under the head, pressurized by (spas) “submersible pumps for anaerobic sludge” and sludge moving toward “GSPDPTC” only when they open the valves of the loading (sh) “sludge hopper” because of the drop in pressure which activates the nearest feed pump. The others are in function, automatically, again because of the pressure reduction. They similarly also move the anaerobic Alkaline (pvlm “lacustine” – pvmm “marine”) basins of the “GMLED” plant: “Global marine and lacustrine environmental depuration”. In fig. 10:11, we see that the sludge line is indicated by the abbreviation (assc) ” anaerobic submergible sludge collector” since it can easily travel in sea and lake, as the “GSPDPTC” plants which are typically intended sludge located on the banks of water bodies. We can also note that these plants can also purify water entering the ocean and into the lake, passing through a (sd) “sediment basin”, but they can also purify water already present in the basin, raised by (dp) “dewatering pump”; In both cases the purified water outlet (pwo) and in the basin, while the sludge are extracted from (assc). It is very important to remove the sludge produced from organic substances from marine coastal waters and lakes because they are the most delicate ecosystems in the word. From their alteration start climate change. Above all, the mud falls and settles on the bed of the seabed and lake must be reduced. This mud with a stratification and fossilized age will then cause death into the aquatic flora and fauna. With the GMLED and (assc) system connected to the nearest (LDDC) of the “GSPDPTC”, we can fight the serious eutrophication restore oxygen to coastal waters and lakes, and improve the quality of the air and water you breathe in lakeside towns such as Venice, contributing also to produce energy with which we extract the sludge, since energy crops that have a good digestive efficiency should be diluted with fresh mud, no septic, such as that produced by the current sewer system.

For this reason, the proposed innovations of a system comprised of (GSPDPTC), (GUED), (GMLED) and the other subsystems, will lead to unprecedented degree of advancement in the fields of environmental protection, energy production as well as civil construction, mechanical engineering and agricultural production, benefiting both people and the environment. From the industrial scale recovery of heat and CO2 will be born the economy of the future that will transform many major sectors including industrial energy, agricultural and waste water treatment:

- Processes such as digestion and composting can be applied to depuration in urban centers;
- Accumulating rainwater in VSB and recycling will help to cool the power stations and heat the digesters to produce biomass for bioenergy;
- The buildings will manage our water cycle for agriculture and irrigation by buffering large quantities of water and safeguard against both drought and floods
- (GSPDPTC) installed near the ocean can desalinate large quantities of water through a process which is far simpler and powerful than that currently employed.

As mentioned in disclosure of background art, the industrial wastewater treatment plants as well as thermal plants today are designed as autonomous plants, existing as wholly separate from each other. There are some cogeneration plants that produce energy from biomass but consume 40 % of the energy produced to heat the anaerobic digesters and to power other plant processes. These plants produce sludge and liquid digestate and yet, do not purify the CO_2 resulting from the flue gas. The solution developed is called “global synergy plants for depuration, biomass production and thermoelectric cogeneration” (GSPDPTC), as the systems created will allow the purification of the global environment by recovering heat and CO_2 to produce new energy. It expands the functions of heating systems with new sections that recover heat [smokestacks (CCPC) digesters (LDDC) and manufactured gases (VSB)], and another section that recover and consume CO_2 (greenhouse buildings with energy production, biological ponds, greenhouses limestone), and others that produce new energy (digester gas tanks, CTEbio). By connecting the new to the old sections to form a closed loop, it recovers the heat in the cooling water and does not expel the smoke through the chimneys but through the limestone greenhouses where CO_2 is consumed in a geochemical reaction and turned into a useful by product. Infact, these depuration processes acting with all the other synergistic processes within the system increase the overall efficiency of energy production.

From Fig 1 and 2 it can be seen that the plant (GSPDPTC) show two chimneys (CCPC), belonging to generic thermal plants: fossil (TEPfos) or bioenergy (TEPbio). Obviously, if the system (GSPDPTC) is designed to improve the efficiency and clean energy of a thermal power plant that is already using natural gas or a compatible light fuel (such as diesel) there will only be a single chimney required. The new chimney serves to channel the fumes into the limestone greenhouse but also acts as the first cooling stage for the fumes. The second cooling stage occurs in the limestone greenhouse (vcmlg) when the flue gas enters and mixes with atmospheric air. A shower of water that arrives at the top of the limestone chamber from a variety of sources descends from pans to infinity (wot) on to the baskets filled with limestone (cwhb) where they react along with the CO2 to create carbonate-rich water. As seen from Fig 1, 2 and 3, all the heat contained in the catchment areas of the hot waters (hwb) and a good part of the content in the fumes (which are mixed with the air) is used in the plant to produce biogas in the digesters (dg) of the building (LDDC), biomass energy in the greenhouses of the buildings “VSB” (vmcpg, bcsvp, pbma) or to erode the limestone rocks that produce carbonates in water (vcmlg) which fall in the basin (wba).

An example with a fossil fuel thermal plant having a gross power of 320 MW is now given to illustrate the detailed calculations used to convert a convention power plant into a (GSPDPTC) plant. In this example, we further assume:

- power absorbed by the auxiliary services = 16 MW ;
- net power to the grid = 304 MW ;
- net output of the plant = 0.55;
- natural gas PCI = 11200 kcal / kg = 13kw/kg ;
- steam flow rate at the entrance of the condenser = 619 355 kg / h;
- enthalpy of the steam at the condenser inlet = 566.1

kcal / kg ;

- water temperature at the condenser outlet of 45 ° C;

Based upon this initial data, the required heat to the steam generator will be given by: P = (320 – 16) / 0.55 = 552 MW. The flue gas temperature, thanks to the heat exchangers with the combustion air, is approximately 77-80 °C. The amount of natural gas (NG) to burn will be = 552 000 / 13kw/kg h = 42.461kg / h (59 805 Nm3 / h). The amount of smoke produced according to experimental data, expressed in weight, obtained by burning a kg of fuel with the stoichiometric air in the absence of CO, taking into account humidity media contained in the fuel, of any ash or sediments and the average moisture content in air is estimated at 18.18 kg / kg of fuel to which are added a 5% excess air. So the total amount of smoke produced is of 810 538 kg / h (42 461 * 1.05 * 18.18). The amount of CO_2 produced, compared to the atomic weights is equal to 44 /12 (3.66) kg CO_2 per kg of carbon in methane gas mixture 12/16 (0.75). Therefore, the amount of CO_2 produced is = 42 461 * 0.75 * 3.66 = 74 093 kg / h which represents a percentage in the flue gases of about 9.14% (6 % by volume). Starting from the heat of the steam to be disposed at the turbine outlet, the heat exchanged total will be: Q = Port. Vap. * (Hv – hc) = 619.355 * 103 * (566 1- 45) kcal / h = 322 745 890 kcal / h. By establishing a temperature difference of 8 °C, we can then size the dimensions of a heat exchanger required to heat the digesters (dg) based upon the above assumptions. The transmission of heat inside the digesters is between a between a fluid in motion and one stagnant. We use the following expression: A = Q * [ln (T1- t) – ln (T2 -t)] / k * (T1 -T2), where “T” is the temperature of the heating water (45 – 37) and “t” the water temperatures in the digester (35), K is the transmission coefficient of water / water, through walls of steel = 280; Then a = 322 745 890 * 1.38 / (280 * 8) = 198 834 m2. The flow of water is given by: P = Q / T = 322 745 890 /8 = 40 432 236 L / h. Using for the tube bundle of the heat exchanger tubes made of stainless steel

with outer diameter of 114 mm and outer surface area of 0.3876 m^2, we can calculate the required total length of tubes: 512 988 m of tubes (= 198 834 / 0.3876). The length of tubes per digester (dg) is simply given by: 512 988 / 20 = 25 650 m of tubes. There are 36 bundles so the length of each bundle is given by: 25 650 m / 36 = 712 m / bundle before exiting from the section. The flow rate in each tube is: 56 000 L / h [40 432 236 / (20 * 36)]. The tube bundle cross with a round-trip digester linear length of about 300 m. So we have 20 (LDDC) linear digesters dehydrators composters of sludge matched with 20 gasometers and gas flares of vented gas. The latter, gasometers and gas flares being part of a known and existing technology are not herein described.
The chemical reaction: $CaCO_3 + CO_2 + H_2O \leftrightarrow Ca^{2+} + 2 HCO_3$ takes place in the limestone greenhouse (vcmlg) and consumes CO_2 and H20 to produce carbonate-rich water that drips into the basins of water to be alkalized (wba) located at the bottom of the limestone greenhouse of “VSB”. To consume the entire 74 093 kg / h CO_2 contained in the flue gas flow rate of 810 538 kg / h , the reaction must dissolve 94 098 kg / h = 74 093 * 56 /44) of calcium oxide from the suspended limestone, based on tables of molar weights. Assuming an average of 400 mg/L of calcium per litre of water, through the various steps, the reaction will consume at least 240 000 000 L / h (94 098 kg / h * 10^6 mg/kg / 400 mg/L) to consume all the CO_2 and liberate Ca from the limestone according to the above equation. Obviously, the flow of water that will pass in the covered dock will vary depending on its availability from the source basin near the plant. To maintain the water flow rate required to consume all the CO_2, it is important to continuously lift the proper amount of fresh water to the trays (wot). The flow rate is affected by recirculating the same water several times through the biological ponds following optional vertical (bcsvp) (aided by the use of baskets containing ion exchange resins to soften the water) and the limestone greenhouses (vcmlg). In the event of water

shortage, sections (vcmpg) can be eliminated and sections (bcsvp) increased to improve the overall regenerative capacity of the water through the increased volume in circulation, the surface exposed to photosynthesis, and the number of baskets with ion exchange resins. The waters will have the following origin:

a) water taken from the central area of the basins (wba), also fed directly from the water bodies upstream (wbup);

b) water heating the digesters (dg) and vertical greenhouses (vcmpg) ;

c) water overflow (purified by successive steps of biological ponds optional), which protrudes from the upper floor (fbcvp).

As for the air circulation, suppose that, between the first cooling phase in (CCPC) and the second, we mix the approximately 810 500 kg / h of flue gases, containing a CO_2 content of 74 000 kg / h, with a flow rate of fresh air of about 3 500 000 kg / h. The internal thermo hygrometric conditions of the greenhouse must be optimized for the calcareous reaction. The fumes enter and are mixed with the air and set to 30 ° C with 100 % humidity. The temperature will depend on the availability of cooling water and the external thermo hygrometric conditions. Therefore, to control the indoor environment, the fans must be controlled based upon inputs from hygro-thermometric sensors. In these conditions, we would have an enthalpy J = 23.7 kcal / kg and a quantity of heat to be extracted from the greenhouse of 102 158 850 Kcal / h (4 310 500 * 23.7) through the air and the water coming out from the plant. The actual amount of CO_2 that will be absorbed by the baskets of limestone, will depend on the climate system demand of the production greenhouses (vcmpg) – which is accessible to workers, where the concentration of CO_2 (and other gases) will be monitored through sensors. In these greenhouses the absorption of CO_2 will vary depending on the state of the crops. In the limestone greenhouse (vcmlg) the average concentration of departure will be the mixed air. For reference, we consider that the air sucked from (bcsvp) + (vcmpg) has the average concentration of CO2: 1.76% [(76 158 / 4 310 500) * 100] (1.14 % by volume), that will be further diluted with the air ventilation of the greenhouse. This air at atmospheric pressure at sea level and has a density of 1,165 kg / m3 therefore occupies a volume of 5 021 732 m3 (4 310 500 * 1 165). In any body of the 20 buildings will have a volume of air mixed to approximately 30°C of about 251 086 m3 / h of air (5 021 732 / 20). Moreover, having fixed length of 300 m and the height of 70 m establish an approximate volume of about 400 000 m3 for the central body called (vcmlg), to which, as anticipated, we must complement on the two sides of the (bcsvp) + (vcmpg), which will be contained in the same environment that, overall, adds a further 300 000 m3 per side.

Energy crops in regular fields have an average production capacity of about 47 t / ha. When cultivated in a greenhouse environment, yields increase by approximately 42% to give production of 66.7 T / ha. Notwithstanding , the specific capacity of 389 m3 biogas / T biogas, each hectare cultivated in greenhouses, combined with a CTE with combined cycle can produce about 100 000 Kw / year (66.7 * 389 * 7.04 * 0.55 kW/m3). But in the artificial greenhouse production environment, this output can be multiplied by the number of floors in the building. In our case, considering a building with 12 floors (the ground floor was reserved for maintenance on the racks, the racks sludge thickening, etc. and all plant regeneration of ionic resins) with biomass production occupying about 172 acres (20 * 24 * 300 * 12/ 10000) and a production of about 2,170 Kw / h (17,200,000 / 330 * 24). This energy production, while not negligible, is only a small fraction (0.7 %) of the energy produced by the plant (304 MW / h). This is acceptable though, as the main task of the VSB system is to clean energy through the limestone reaction, not to produce it. Since one mole of methane corresponds to one mole of CO_2, we can say that photosynthesis contributes little to the production of energy. In contrast, the (LDDC) possess a surprising amount of digestive capacity, and therefore of biogas production as well. In total, the 20 digestive buildings will have a total volume of 400,000 m3, of which 260,000 m3 is occupied by liquid digestate and 140,000 m3 occupied by digestion gas. If matrices of high quality biomass are fed to these digesters, they are capable of producing 390 Nm3 / t of biogas …more than the consumption capacity of the plant itself. In fact, the biogas produced is calculated as 112,666 Nm3 / h [(260,000 * 0.40 * 390) / (15 * 24)] and ensure energy capacity in the hearth of 721,000 Kw / h against the 552,000 Kw needed. This capacity could be increased by another factor of ten if (VSB) is used to exclusively cultivate microalgae.

The accompanying drawings shows the most common case, a thermal power plant powered by fossil fuel, whose chimney (CCPCfos), does not expel fumes. The fumes rise to the top, whereupon they meet with air drawn from the outside, due to the suction of one or more electric fans (eff) sized to ensure a sufficiently low pressure in the chamber (es). This differential pressure draws down the hot fumes which are then forced to pass through an electrostatic filter (fes), the output of which is mixed with fresh atmospheric air. The mixture of air and fumes, still hot, travels downwards and releases its heat to the water that circulates in a tube bundle spirally wound on a central chimney (fghe). The warm waters are collected in the basin (hwb), while the fumes are conveyed in the channel (hwfc), kept in constant depression by electric fans (eff) which transfer the hot fumes into the environment (vcmlg), in which the fumes are mixed with other air blown by the fan assemblies (efa). In this environment, the large volumes of CO_2, being heavier, tends to stagnate in the lower area of the room while the water vapor and the air will tend to stratify in the higher areas and exit through the openings in the roof (aout) with one-way dampers. As can be seen from the same drawings, all water raised to infinity tubs (wot), including rain across the area (vcmlg) are stored and arranged in rows and plans of the metal baskets (cwhb) of the hanging limestone trolley. The water falling from above rains down on to the crushed calcareous rocks where the mixture of air, steam and CO_2 brings about a reaction that creates aqueous carbonate molecules. The crushed rocks present a large surface area of limestone to accelerate the reaction. The carbonate solution drips down and is collected in the basin of water to be alkalized (wba) below.

The logistics of VSB. As seen from fig. 3 – 4 (vcmpg, bcsvp, pbpma) are arranged laterally to the central limestone (vcmlg) to take advantage of natural light, appropriately supplemented with artificial light. The covers of (bcsvp) will consist of gratings with large voids to allow the passage of light. In this way they can serve as walkways and can also accommodate (pbpma), photo bioreactors for the production of microalgae, currently the most promising technology for biological energy production. The photosynthetic sections exploit the heat from the tube bundle (hwp) and the proximity of the section (vcmlg) from which it will pick up warm, moist, CO_2-rich air blended with outdoor air in special (ahu), air handling units, and which is controlled by humidity, temperature and CO_2 sensors. This will exploit the CO_2 fertilization effect and create optimal growing conditions for the production of agricultural biomass and water throughout the year. Nom-motorized mechanical handling and storage systems of baskets are dragged by chains within the vertical greenhouse buildings to transport limestone (cwhb) and resins (cwhr). In addition there are (emr), equipped motorized rack, used for tillage and harvest. The “VSB” possesses varying degrees of automation: moving baskets and suspended, motorized racks and carriages or alternatively manually pulled from one floor to another and from one lane to another, following predetermined paths with longitudinal, horizontal or vertical translation, moving through translational and lifter tracks that carry the motorized trolleys, baskets or racks. The equipped motorized rack will be equipped for the treatment of the surface of the soil, sowing, cutting, chopping and the aspiration of the powder. Since the energy production is very simple from an operational view, these can take place completely automatically. The harvest, shredded and aspirated through suction channels, is sent to the biomass storage silo (sbm). The automatic handling of baskets (cwhb and cwhr) and hangers (Emr) travels through the stations on the ground floor, where they are cleaned and filled equipped. In the case of the system of ion exchange, washing and regeneration is performed at stations throughout the the entire path. At the end baskets and racks are inserted into appropriately equipped hoist equipment (mscb) which is located just outside the structure of the building, and which again operate automatically, according to programmed cycles, reliefs, arriving at each floor then insert or draw the baskets or bilancelle through swing doors. The automatic system closes with rubber seal to prevent escape of the fumes and electrically powered, push the element in transit. We do not enter into the merits of the level of automation of transport widely used in the industry. In the case of agricultural production, it will not be necessary or convenient to electrify all paths, due to rains and corrosive agents which would pose a maintenance problem. Only those sections external to (VSB) consisting of sorting baskets and trolleys racks, through exchanges, descenders / elevators and hoists are electrified. Only the transport carriages of the suspension bars and agricultural equipment mounted on the same are electrified using DC motors powered by interchangeable batteries. The pneumatic transportation system for crushed rocks has also been widely tested in industry. For the suction of the chopped by the hanger equipped in motion, the equipment used will be a suction manifold equipped with a slit covered by rubber lips which open to the passage of shaped metal end of the suction pipe of which will be equipped with the equipment mounted on the hanger for cutting and chopping intake of the crop. After the chapter on the state of the art, which drew the previous inventions of “GUED”, “GMLED” and the disclosure of these inventions, we can better understand the diagram shown in Figure 5. Positioning (GSPDPTC) downstream of (GUED – GMLED) the line anaerobic sludge (asc) to go to (LDDC), the water line to go to (upwb), and the line of the captured mixture gas captured (cmCO2) to go to the building (VSB). Descriptions of the (GSPDPTC) system explain how it can be used to successfully combat air and water pollution in a large urban centers such as Beijing at the same time producing energy. Similarly, detail explanation of the invention of the new chimneys (CCPC) explains how this system can also purify the air and water of a small village while producing energy. In fact, even if small communities cannot afford a thermal power plant with turbine and water-cooled condensers, it can certainly afford a small power generator fueled with natural gas and biogas. Even in smaller applications such as these, it is not be a problem to at least capture the heat of the fumes generated through the coil of water that circulates in the chimney (CCPC) food with heated water heats a small gas boiler that then heats more water to recover the heat from the boiler flue gas, using the same coil to heat a mesophilic digester (which needs a water temperature of 37°C) of appropriate size to the needs of the small community and pair it with a small gasometer and a small (VSB). What is important to note is the fact that the “purifying urban vertical module” (pvum) provided for in “GUED” may not only be connected together with the line (asc) but may also undergo a “mini green house glazing ” (mgg), within which lay a small section of Vertical covered mechanized limestone greenhouse (vclmg) which would serves both to oxidize the water and alkalization without resorting to the use of calcium oxide.

Brief description of drawings. In the Disclosure of Invention has described the operation of the (GSPDPTC) and shows the meaning of the most important acronyms. For better clarity, a legend of acronyms concerning the related systems is provided below.

Legend: (ac) air compressor; (af) air filter; (ags) agitator sludge; (ahu) air handling units; (aid) air inlet dampers; (aout) air outlet; (acwhs) arrival cooling water heating system; (apt) atmospheric pressure tank; (art) anionic regeneration tunnel, (as) arrival sewer; (asc) anaerobic sludge collector; (assc) anaerobic sludge submergible collector; (avhe) heat ewchanger; (agrw) agricultural wastewater; (aws) alkaline water supply; (bcf) biogas cyclone filter; (bc) bagged compost; (bcsvp) biological covered superimposed ponds; (bmh) biomass hopper; (bms) biomass silo; (bioc) biogas collector; (brse) basket and racks elevator; (bws) boiler water supply; (casrb) covered area sorting racks and baskets; (ccc) central covered channel; (CCPC) capture cooling purification chimney; (cf) cyclone filter; (cd) conical diffuser; (clp) condensate lift pump; ($CMCO_2$) collector transport compressed mixture of air and CO2; (cr) carriage road; (crt) cationic regeneration tunnel; (csc) collecting stones channel; (ct) condensation tank; (cwhb) calcareous wheeled hanging baskets; (cwlp) cold water lift pump; (cchwf) covered channel for hot water and fumes; (cws) cold water supply; (db) domestic boiler; (dlh) digester loading hopper; (dp) dewatering pump; (dst) detergent solution tank; (dwb) downstream water body; (dst) distribution smud tank; (dw) depurate water; (dwt) desalinated water tank; ($ebCO_2$) electroblower for CO_2; (ebbio) elettroblower for biogas; (efa) electric fan for air; (eff) electric fan for fumes; (esf) electrostatic filter; (emr) equipped motorized rack; (ethw) espansion tanks for hot water; (etcw) espansion tanks for cold water; (fai) fresh air intake; (fcv) flow control valve; (fvhe) fumes vapor heat exchanger; (fgec) flue gas expansion chamber; (fgwe) flue gas water exchanger; (fbcvp) final biological covered vertical pond; (fgfs) flue gas filtration system; (gas) gasometer; (gf) grating floor; (GMLED) global marine and lacustrine environmental depuration; (GUED) global urban environmental depuration; (gw) glass wall; (hwb) hot water basin; (hwp) hot water pipes; (hwcb) hot water covered basin; (hwcp) hot water circulating pump; (hwfc) hotwater and fumes channel; (hwlp) hot water lift pump; (hws) hot water supply; (lf) lower floor; (lbh) limestone boulders hopper; (LDDC) linear digester dehydrator composter; (ls) lime silo; (mgg) mini glazing greenhouse; (pbpma) photobioreactors for the production of microalgae; (pcbio) pneumatic conveying biomass; (plv) rain; (pfb) public facility boiler; (pvmm) purifying vertical marines module; (pvum) purifying vertical urban module; (pwdv) purified water drain valve; (pwo) purified water outlet; (rfwt) resins final washing tunnel; (rm) removable cover; (rcpld) road control panel with mini limestone dosing hopper incorporated; (rrpwl) recovery rainwater and purified water line; (rsiet) regenerating solution ionic exchange tanks; (rrt) resin regeneration tunnel; (rwt) resins washing tunnel; (rww) resins washing water; (rwhb) resin wheeled hanging baskets; (se) stairwell and elevator; (sfgc) settling flue gas collector; (sh) sludge hopper, (sk) skylight; (sid 1-2) smoke interception damper; (sle) sump sludge extraction; (slp) sludge lift pump; (sov); shutoff valve; (spas) submersible pumps for anaerobic sludge; (ssl) settler in sewer line; ($STAMCO_2$) storage tank atmosferic mixture of air and CO2; ($STCMCO_2$) storage tank compressed mixture of air and CO2; (stt) sludge tape transport; (tsp) transparent solar panels; (ttst) transit tank of sludge to be thickened; (rwv), recirculating water valve; (TEPbio), thermoelectric power plant fueled by biogas; (TEPfos) thermoelectric power plant fueled with fossil fuels; (tucCO2) thickening CO2 underground collector; (uf) upper floor; (upwb) upstream water body; (uv) unidirectional valve; (vcmlg) vertical covered mechanized limestone greenhouse; (vclmg) vertical covered limestone mechanized greenhouse; (vahe) heat exchanger; (vm) vertical mixer; (vmcpg) vertical mechanized covered production greenhouse; (VSB) vertical synergic building; (wb) water body; (wba) water basin to be alkalize; (wbc) water cooling basin; (wbp) water basin to be purified;

(wlp) water lifting pump; (wfd) washing floor drain; (wodc) water overflow and drainage channel; (wot) water overflow tray; (ws) water supply; (wss) water sofned supply.

The drawing ” 1/6″: fig. 1 is the diagram of a global synergy plants for depuration, biomass production and thermoelectric cogeneration (GSPDPTC) in which are inserted VSB together with other industrial installations: 1 (TEPfos), 2 (CCPC fos), 3 (VSB), 4 (LDDC), 5 (TEPbio), 6 (CCPCbio). Where (TEPfos) produces fossil energy, heat, fumes and CO_2; transfers the CO_2 and the heat of the fumes to (CCPCfos), while the heat content in the water goes to (LDDC); (CCPCfos) transfers the heat to (LDDC) and CO_2 to (VSB). This produces biomass, which transfers (LDDC) and alkaline waters that sends to the seas; (LDDC) produces biogas, which transfers (TEPbio), solid digestate for agriculture and the liquid digestate that moves to (VSB), while the hot smoke with CO_2 ranging in VSB. Meanwhile (TEPbio) produces biological energy, heat, fumes and CO_2; transfers the CO_2 and the heat of the fumes to (CCPCbio), while the heat content waters goes to (LDDC). The cycle can continue indefinitely coexist in the same system as fossil fuels and organic which together produce clean energy, compost for agriculture and alkaline waters to combat ocean acidification. But (VSB) with different management can also desalinate sea water. Many technologies come into this system; the applying claims only (CCPC), (VSB), (LDDC), (GSPDPTC).

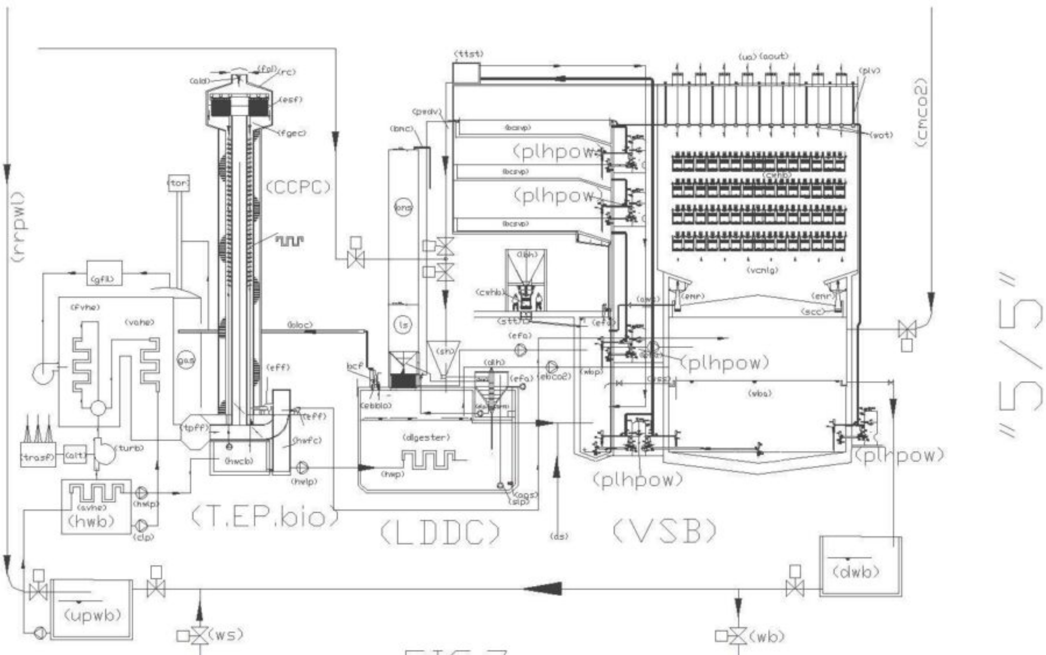
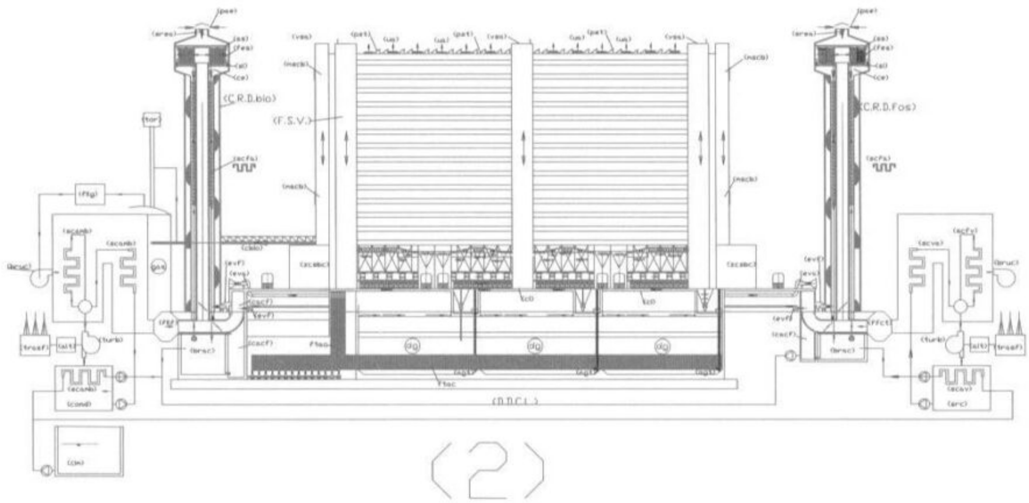


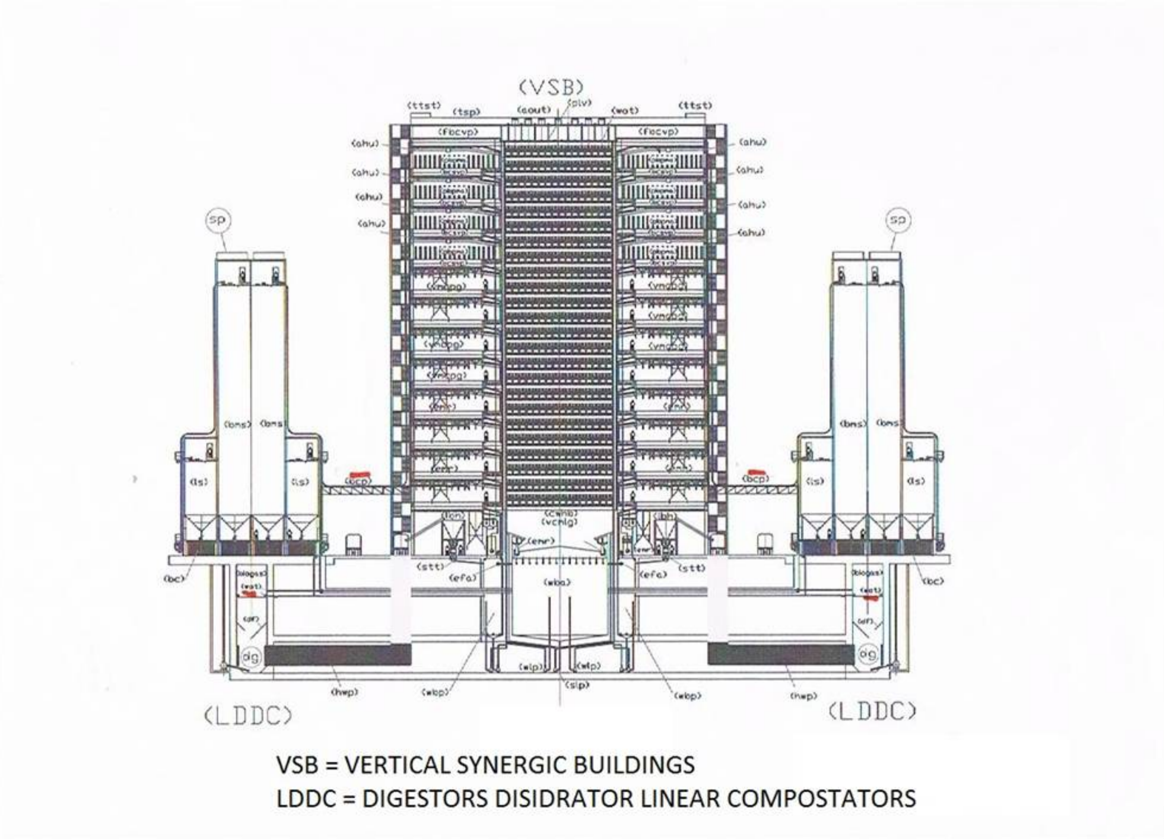
FIG.7

Drawing 2/6: fig. 2 is the longitudinal view of VSB, where the area on the ground floor with the transit of baskets (cwhr) and (cwhb) is visible and superiorly, purifying the area and production of biomass. Notice that (bcsvp) superimposed covered biological ponds are always present, although the narrow version, when combined with (vmcpg) vertical mechanized mechanized covered greenhouse production; notice the two heads of the building (Brse) basket racks and elevator, without which it is not possible to realize the industrialization of environmental protection. Solar panels run along the transparent roofs of the buildings. Fig 3 is the magnification of the work area on the ground



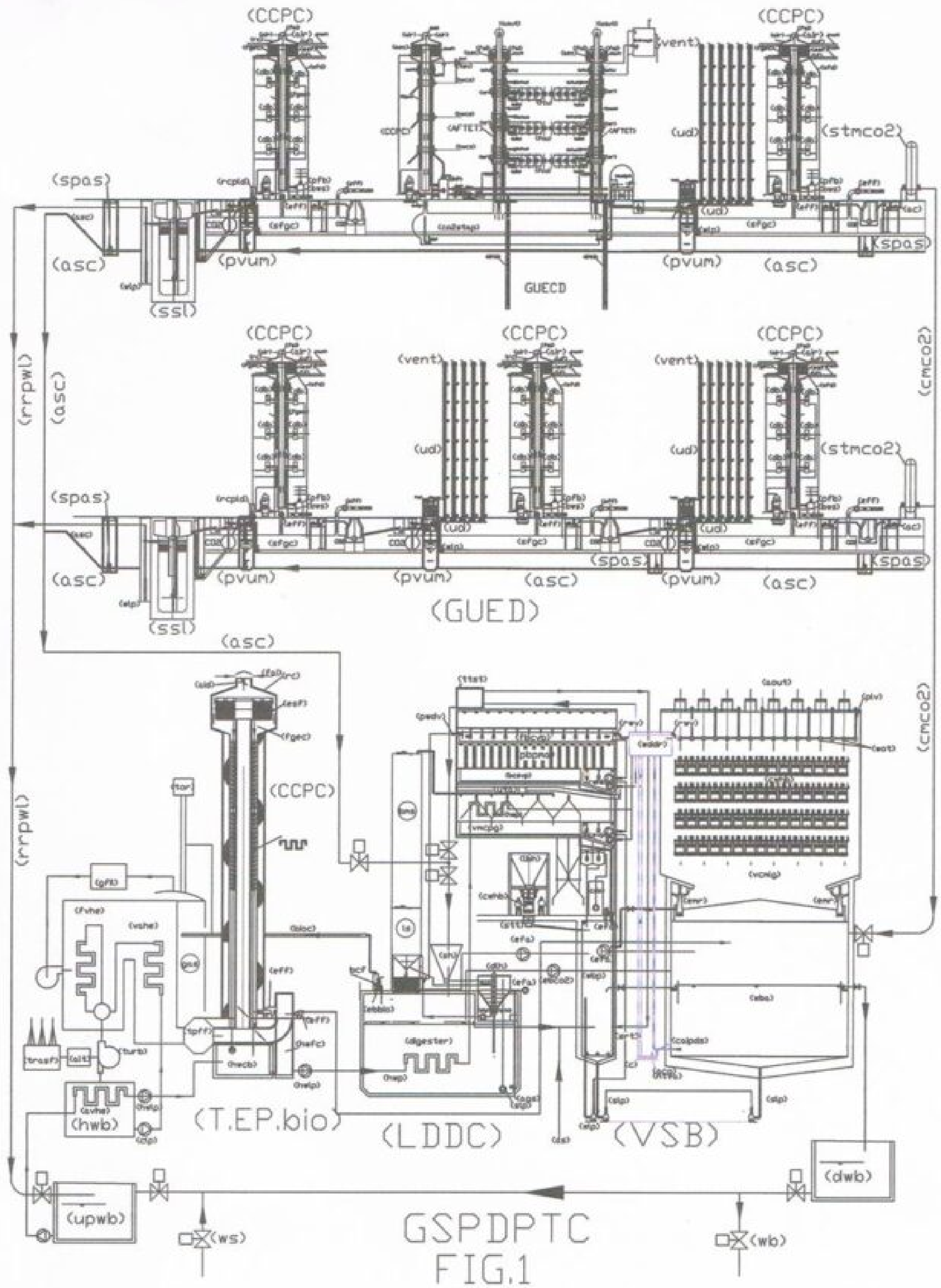
(2)

Drawing “3/6”: fig. 4, is transversal section, views of a global industrial sewage treatment plant, where it shows the connections between the air and underground buildings (VSB) and (LDDC).This drawing shows the silo of biomass (bms) and calcium oxide (ls), the bags with the draining compost (bc), the link between the limestone section and the digesters, the chamber containing biogas with the basin of water to be alkalized (wba) for the CO2 stripping, and air composting and dehydration always with same basin (wba) which does not broadcast outside odors. All aerobic processes of the building (LDDC) reach the atmosphere passing through vertical building (VSB), in particular limestone section (vcmlg) and exits into the atmosphere (aout). The water contained in hot water pipes (hwp) will contribute to warming and drying of the greenhouses (bcsvp), (vcmpg), (pbpma) and will end in the water overflow trays (wot) on top of the limestone greenhouse.



The drawing "4/6": fig. 5 shows the scheme of (GUED), "global urban environmental depuration" and the scheme of (GMLED) "global marine and lacustrine environmental depuration" integrated in the system GSPDPTC, described above, in which there are the urban version of: 1 (CCPC), 2 (VSB), 3 (LDDC), 4 (TEPbio) for application in urban environments that produce fossil and bioenergy, heat, smoke, CO2 and polluted water. The heat of urban (CCPC) goes to (db) domestic boiler, the heat of urban (TEP) and its (CCPC) goes to (LDDC); urban CO_2 from the TEPs and (db)$_s$ goes to (VSB). (VSB) produces biomass, which is transferred to (LDDC) and alkaline water that is sent to the sewer system, which will be very different from the current system because it does not produces hydrogen sulphide, but purifies the water and capture CO2 and smog. In the same figure is too reported the marine and lacustrine application using the same (pvm) with a different composition. (LDDC) produces digested solids and liquids, as well as biogas that is transferred to (TEPbio). The digested solid is used for agriculture while the digested liquid is transferred to (VSB).

This loop can continue indefinitely with a coexistence of fossil fuel and biological systems to produce clean energy, compost for agriculture and alkaline water to reduce ocean acidification. In order to obtain the maximum performance from entire system it is required to change the “purifying urban vertical module” (pvm) provided in GUED, and GMLED so that not only must it be connected together with the anaerobic sludge collector (asc – assc), but must also be placed under a “mini glazing green house (mgg), within which there will be a small section (vclmg) that is used to oxidize and alkalize the waters and neutralizes CO_2 without resorting to the use of calcium oxide. This is not always possible due to space limitations in the old urban centers, but it can be located anywhere there is space, such as a bed or a roundabout. In Figure 5, we report (pvum – pvlm – pvmm) with (mgg) or a “road control panel with mini limestone dosing hopper incorporated (rcpld)”.



GSPDPTC
FIG.1

LEGEND

GSPDPTC (GLOBAL SYNERGY PLANT FOR WATER AND AIR DEPURATION BIOMAS PRODUCTION, THERMO ELECTRIC COGENERATION)
acg (alternating current generator); aout (air outlet); asc (anaerobic sludge collector); bcsvp (biological covered superimposed ponds); bms (biomass silo); c (collector); calpds (capsid axial intubate pump with dual suction pump); CCPC (capture cooling purifier chimney); cmco2 (collector transport compressed mixture of air and co2); dlh (digester loading hopper;); dwb (downstream water body). fbcvp (final biological covered vertical pond); gas (gasometer); ebco2 (electroblowerfor CO2); ebbio (electroblowerfor biogas); efa (electric fan for air); emr (equipped motorized rack); esf (electrostatic filter); GUED (global urban environmental depuration); htva (hydraulic turbine with vertical axis); hwp (hot water pipes); LDDC (linear digester dehydrator composter); ls (lime silo); mgg (mini gazing greenhouse; pbpma (photobioreactors for the production of microalgae); plv (pluvial for water rain); pvum (purifiervertical urban module); pwdv (purified water drain valve); rwv (recycle water valve; rrpwl (recovery raiwater and purified water line); slp (sludge lift pump), spas (submergible pump for anaerobic sludge); srt (supply reservoir tube); ssl (settler in sewer line); vmcpg (vertical mechanized covered production greenhouse); VSB (vertical synergic building; ttst (transit tank of sludge to be thickened); TEPbio (thermoelectric plant fueled with biogas; vcmlg (vertical covered mechanized limestone greenhouse); upwb (upstream water body); wba (water basin to be alkalize; wbp (water basin to be purified); wddr (water distribution and disconnection reservoir); wlp (water lift pump); wot (water overflow tray).

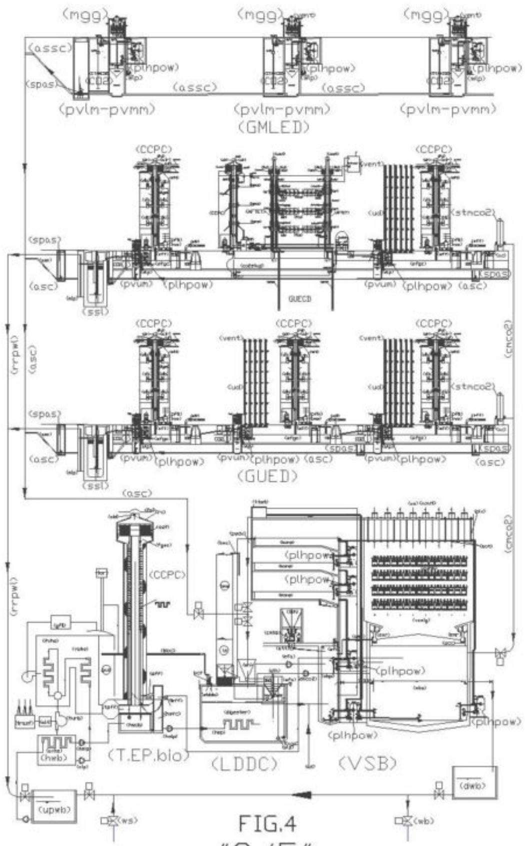


FIG.4
"2/5"

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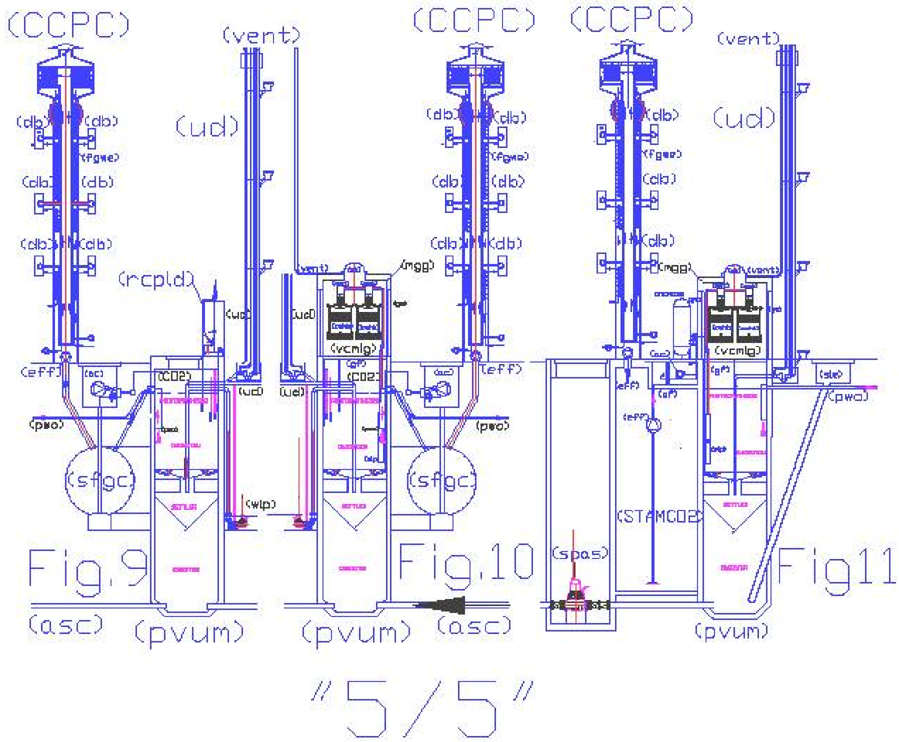
Drawing "5/6″: fig. 6 shows a diagram of an original (pvum) purifying urban vertical module, expected in a global urban sewage treatment plant with "road control panel with mini limestone dosing hopper incorporated (rcpld)". This system can be used in global, urban purification, where there is no space on the surface to achieve the solution shown in **fig.7** and claimed in this "PCT request". Infact, (rcpld) can be advantageously replaced by a (mgg) "mini green house glazing" incorporating a section (vcmlg) vertical limestone covered mechanized green house, superimposed on the (pvum). This system is more efficient in local purifying air and water, which is made alkaline by neutralizing CO_2 without consuming calcium oxide. In urban areas the system Gued + GSPDPTC, locally, works in the following way: The chimney catches the exit air pollution from boilers and furnaces, having purified the fumes with the electrostatic filter and recovered heat to enhance the thermal performance of domestic boiler (db), the fumes are released in "settling flue gas collector" (sfgc) from which the mixture of air and CO_2 through various “air filters” and “air compressors”(ac) compress it in “storage tank” (STCMCO2) and in a network (CMCO2) from which they can fetch both sections of oxidation of local (pvum) that the VSBs basins of oxidation (wba) and (wbp) that exploit the pressure and the oxygen to oxygenate the water, while the CO_2 issued by oxygenated waters, forced to climb the local greenhouses and VSB (vcmlg), is absorbed to produce carbonates in the same waters that fall within their respective basins. In (pvum) it can also consume the nutrients, such as phosphorus and nitrogen by means of photosynthesis permitted by stagnant, oxygenated and lighted surface, since the treated water forced out of a tube going up to at least 100 cm to reach the level of overflow. Even in (pvum) waters are alkalized in the greenhouse by touching trays (wot) and crossing the baskets filled with calcareous material (cwhb) of (vcmlg), although everything is in miniature, in (pvum) modified happen the same purification processes of large VSB. **Fig. 8**, shows that the main functions of oxidation, photosynthesis and alkalization and the flue gas purification can happen even in homes and businesses or industrial blocks from centralized purification systems, supporting chimneys (CCPC) to (pvum) with (mgg) and (vclmg), but adding a storage tank for the atmospheric mixture of air and CO_2 (STAMCO2), storage tank mixture of compressed air and CO_2 (STCMCO2) with its filtration (af) and air compressor (ac). The sludge produced by (pvum) blocks are extracted by means of a tanker truck through “sump for sludge extraction” (sle) and taken to (LDDC). **Fig. 9**, it simply shows that the line “anaerobic sludge collector” (asc) need not necessarily be horizontal, as shown schematically in Figure 5, but can also have detours upward or downward, provided that the pipe is always full and close to the lift pumps are installed always one-way valves that prevent the return of sludge to (pvum). As shows Fig. 5, line (asc) reaches the “sludge hopper” (sh) of (LDDC). **Fig 10** shows an application very similar to Fig. 8 but used in the scheme (GMLED) “global marine and lacustrine environmental depuration” without chimney (CCPC). In fact, this figure marked with (pvlm – pvmm) “purifying vertical lakes-marine module” is connected to the network (assc) “submergible anaerobic sludge collector” The connection brings the semplification of the original version of these depurators that oversees a section of the sedimentation side by the depuratives forms and these pumps of extractions of the muds are not any more necessary, in as much as they are substituted by the “anaerobic submergible sludge collector(assc)”.



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The drawing “6/6”: Fig.11 and 12 shows respectively the Lay out and the section of an important plant (GMLED) -“global marine and lacustrine environmental depuration” updated in respect to the original version with insertment of the superior zone of the mini glazing greenhouse (mgg) and in the inferior zone of the “anaerobic sludge submergible collector” (assc) to send sludge directly to “sludge hopper” (sh) of “linear digester dehydrator composter” (LDDC) of GSPDPTC. We can note that this plant could deal with either the water that enters into the lakes and in large seas, even also in the water that already present. This, thus means that we can depurate and alkanilize a lot of water, and being also that it is a modulate system we may distribute a small element with distance to depurate the waters of a city built on water like Venice substituting the actual sewage system

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